RP 814 Wind Turbine Pitch Bearing Grease Sampling Procedures

The following recommended practice (RP) is subject to the disclaimer at the front of this manual. It is important that users read the disclaimer before considering adoption of any portion of this recommended practice.

This recommended practice was prepared by a committee of the AWEA Operations and Maintenance (O&M) Committee.

Committee Chairs:
Kevin Dinwiddie, AMSOIL
Erik Smith, Moventas
Bruce Hamilton, Navigant Consulting
Principal Author: Benjamin Karlson, Sandia National Laboratories

Purpose and Scope

The scope of “Wind Turbine Pitch Bearing Grease Sampling Procedures” discusses the methods for taking uncontaminated and trend-able grease samples from wind turbine pitch (blade) bearings. Samples that are taken properly can provide the user with accurate data for maintenance decision making.

The general procedure applies to wind turbine lubrication systems. There are several different wind turbine pitch bearing styles and purge recovery systems. This paper will address two such pitch bearing purge recovery styles and can apply to both automatic and manual grease lubrication systems. Following methods laid out in ASTM D7718, “*Standard Practice for Obtaining In-Service Samples of Lubricating Grease*”, these recommendations will give proper procedures for the handling of purge recovery containers, sampling devices, and grease before and after samples have been taken to ensure that data obtained from grease analysis is accurate.

Introduction

Performing grease analysis from a specific sampling location is important in ensuring repeatability and accuracy. Unlike oil samples, which can more thoroughly mix and circulate through a gearbox or other location, greases are semi-solids and their flow behavior is quite different. Known as a “non-Newtonian” fluid, their movement and circulation in a bearing is dependent on the grease consistency, temperature, and force applied by nearby moving components, among other factors.

Introduction
(continued)

Published studies demonstrate that greases in wind turbine bearings do indeed move and circulate, but only in an area very close to the moving parts of the bearing. Therefore, it is critical that any sampling methods provide effective means to obtain grease close to these moving zones or otherwise ensure that grease samples are not compromised by contaminating or diluting influences as they travel away from these flow zones. The methods outlined in this recommended practice provide several approaches to achieve this goal.

Wind Turbine Pitch Bearing Grease Sampling Procedures

1. Method 1: Recovery from Purge Container with Removable Lid

NOTE: In this section, “grease sampler” refers to the “passive grease sampling device” described in ASTM D 7718, Section 8. The “T-handle” describes a tool used to reach the grease sampler into the purge container. This method ensures that the sample obtained is taken from the grease which has most recently exited the bearing. This method references the style of purge container shown in Figure A, common to certain Vestas units.

Figure A

1.1. Remove the purge container from the blade bearing and place the container on a level surface with the removable lid facing up.

1.2. Remove the lid and set aside.

1.3. Verify that there is sufficient accumulation of grease that presents a solid glob adjacent to the lower entry hole and is larger than the length of the grease sampler. If there is not sufficient grease to permit the coring process described here, go to Method 2 to obtain this sample.

1.4. If necessary, remove the grease sampler from packaging used to keep it clean until ready for use. Ensure that the open end of the grease sampler is clear of any cap and that the internal piston is positioned to close off the sampling tube.

1.5. Attach the grease sampler piston handle to the T-handle tool by inserting the end of the handle into the internal rod. *(See Figure B)*

Figure B

1.6. Insert the internal rod into the pusher tube, with the grease sampler facing forward. *(See Figure C)*

Figure C

1.7. Thread the base of the grease sampler into the female threads in the pusher tube and make adjustments to set the depth at which the sample will be taken. Position the T-handle so that the extended position of the open end of the grease sampler will be slightly past the lower entry hole in the side of the container. *(See Figure D)*

Figure D

1.8. Position the pusher tube so that the internal piston is flush with the end of the grease sampler.

1.9. Insert the grease sampler and T-handle into the top of the purge container, keeping close to the wall where the entry holes are located, until the positioning guides of the T-handle contact the top lip of the container, positioning the grease sampler at the lower entry hole.

1.10. Slide the pusher tube forward, while holding the T-handle firmly against the purge container lip, to core a grease sample close to the lower entry hole.

1.11. When the pusher rod has been slid completely forward, hold it in that position as the T-handle and grease sampler are withdrawn from the container.

1.12. Using a clean rag, wipe the excess grease from the T-handle parts and the OUTSIDE of the grease sampler body, being careful not to contact the grease inside.

1.13. Release the internal rod so that it spins freely, and un-thread the grease sampler from the pusher tube.

1.14. If there is insufficient grease to sample using the T-handle, refer to Method 2 to manually extract grease from the lower entry hole area.

1.15. The open end of the grease sampler should be secured by placing a cap over the end prior to shipment. It may be necessary to purge a small portion of the grease from the sampler into the cap to avoid an air pocket being pushed into the sampler, displacing some of the sample through the far end of the sampler.

1.16. Once a small portion of the grease is in the cap, slide the cap on the grease sampler just far enough to engage the end of the sampler as a friction fit.

1.17. Place the filled and capped grease sampler into a suitable shipping tube to prevent leakage from the grease sampler and protect it during shipping.

1.18. Affix a sample label on the shipping tube, filling out all necessary information clearly and legibly, including equipment identification, sample date and time, sampler’s name, and any notes or observations for the lab. Ensure all samples are clearly identified and promptly submitted to the lab for analysis.

2. Method 2: Recovery from Purge Container without a Lid

NOTE: This method follows guidance provided in ASTM D7718, Section 10. This method assumes that the purge container opening is too small to allow the insertion of a grease sampler inside the container and that the grease is to be manually extracted using a disposable spatula.

2.1. Using a clean, lint-free rag, wipe the outside of the grease purge container and surrounding area of the pitch bearing to avoid any of the external contamination from getting into the grease sample to be taken.

2.2. Remove the purge container, as shown in Figure E, from the pitch bearing and set on a level surface with the open end facing up. Other styles of purge container can also be used in this manner.

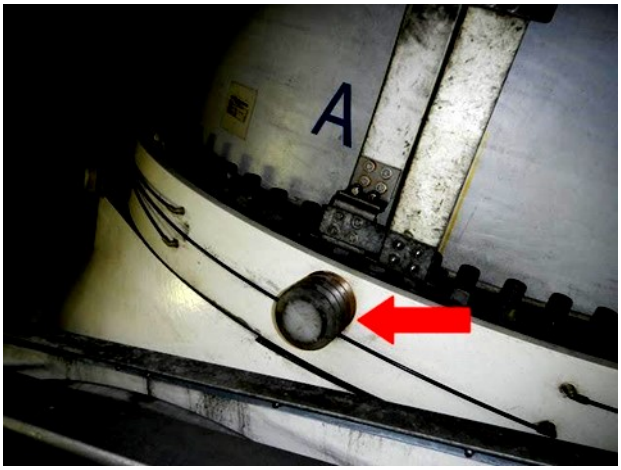

Figure E

2.3. Inspect the exit hole in the bearing to determine if there is sufficient grease accessible in this area for the required sample size.

2.4. Using a clean spatula or straw, remove grease from the inside of the drain area up to a point within about 1” of the moving parts of the bearing, if possible. Ensure that in this purging step, a sufficient amount of grease remains to obtain the required sample amount.

2.5. Utilize a new, clean spatula or straw to gather grease from that area directly adjacent to the moving bearing parts and pack the grease into an opened syringe. The syringe is opened by removing the plunger. In place of a syringe, a similar suitably clean, closeable container can be used to gather the sample. If the analysis to be performed is a small-volume method as outlined in RP-814, it may be necessary to use the syringe to inject grease into the “passive grease sampling device” described in ASTM D7718.

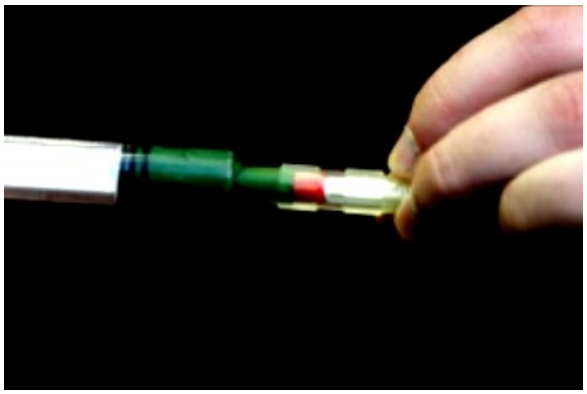

Figure F

2.6. Additional grease can be put into the grease sampler by re-inserting the plunger in the syringe and pushing grease into the grease sampler to achieve maximum fill.

2.7. If there is insufficient grease in the drain path to fill the grease sampler, the remaining amount can be obtained from the area near the opening inside the purge container. The grease closest to the opening is the most recently purged grease and the most representative of the current condition of the bearing.

2.8. The open end of the grease sampler should be secured by placing a cap over the end prior to shipment. It may be necessary to purge a small portion of the grease from the sampler into the cap to avoid an air pocket being pushed into the sampler, displacing some of the sample through the far end of the sampler.

2.9. Once a small portion of the grease is in the cap, slide the cap on the grease sampler just far enough to engage the end of the sampler as a friction fit.

2.10. Place the filled and capped grease sampler into a suitable shipping tube to prevent leakage from the grease sampler and protect it during shipping.

2.11. Affix a sample label on the sample container, filling out all necessary information clearly and legibly, including equipment identification, sample date and time, sampler's name, and any notes or observations for the lab.

2.12. Place the sampling container inside the shipping envelope or box and promptly send to the lab for analysis.

Summary

Proper grease sampling methods are crucial for comparing samples from one turbine to another or for trending samples from the same turbine. If the proper methods are not employed, grease samples can be obtained that do not represent the condition of the bearing wear, contamination levels, or the physical properties of the grease actively involved in lubricating the bearing. Any analysis from such inadequate samples will be misleading and result in improper maintenance actions being taken. Properly obtained samples ensure that analysis results represent current bearing conditions and provide the basis for sound maintenance decisions to provide reliable pitch bearing operation.